REMARKS

This paper responds to the Office Action mailed on September 6, 2007.

Claims 1, 8, 12, 13, 52, 62, 63 and 67 are amended, no claims are canceled, and no claims are added. Accordingly, claims 1-13, 52-53 and 60-70 are pending in this application.

§102 Rejection of the Claims

Claims 1-4, 8-13, 60-61, 63 and 67 were rejected under 35 U.S.C. § 102(e) as anticipated by U.S. Patent No. 6,403,441 to Takehiro, *et al.* (hereinafter, "the Takehiro reference"). Applicant disagrees with the stated grounds of rejection and desires to further clarify various distinctions of the present invention over the cited art. Reconsideration of the present application is therefore requested in light of the present amendments and following remarks.

Although the disclosed embodiments of the invention may be discussed in comparison to the prior art, it is understood that any discussion of the disclosed embodiments, as well as any discussion of the differences between the disclosed embodiments of the present invention and the prior art do not define the scope or interpretation of any of the claims. Instead, such discussed differences, if presented, are offered merely to help the Examiner appreciate important claim distinctions as they are discussed.

The Examiner has introduced the Takehiro reference as anticipatory to the present claims. The Takehiro reference discloses a method for fabricating a capacitor structure in a semiconductor substrate, and more specifically, a storage capacitor that may be employed in a memory device, such as a DRAM. With reference to Figures 2(a) through 2(d) in the Takehiro reference, the disclosed capacitor structure is fabricated by forming a barrier metal film 5 and a Ruthenium-type lower electrode 6 on a supporting insulating film 3. A dielectric initial layer 9 is then substantially formed over the lower electrode 6 and the supporting insulating film 3 by subjecting the structure to a voltage applied by a high frequency voltage source that is coupled to the structure. Since the applied voltage

is negative relative to the applied plasma potential, barium strontium and titanium ions constituting the initial layer 9 are driven into the lower electrode 6, while ruthenium from the lower electrode 6 is thus "melded" into the dielectric initial layer 9, so that a $SrRuO_3$ is ultimately formed. The Examiner is directed, in particular, to into the disclosure contained in col. 6, lines 57-67, and bridging to col. 7, lines 1-43 for this teaching.

Accordingly, Applicants understand the Takehiro reference to teach a semiconductor fabrication method wherein a constituent metal (*e.g.*, ruthenium) present in a lower electrode structure that is positioned on a supporting substrate is driven *from* the lower electrode 6 and *into* the dielectric initial layer 9, so that the layer 9 has a predominately $SrRuO_3$ compositional structure.

Referring now to the claims, differences between the claim language and the applied reference will be specifically pointed out. Claim 1, as amended, presently recites: "A substrate assembly, comprising...a support surface...and...a plurality of high-K dielectric layers over said support surface, wherein a common metal is present in at least two adjacent layers of said plurality, and wherein at least two layers of said plurality exhibit different degrees of oxidation so that at least one layer of the plurality of high-K dielectric layers manifests greater oxidation than would an equivalent thickness of an underlying layer of the plurality, *further wherein the common metal does not diffuse from the support surface and into the plurality of high-K dielectric layers.*". (Emphasis added). The Takehiro reference does not disclose this. Instead, the Takehiro reference discloses diffusing ruthenium from the lower electrode into the dielectric layers. Claim 1 is therefore allowable over the applied reference. Claims depending from claim 1 are also allowable based upon the allowable form of the base claim and further in view of the additional limitations recited in the dependent claims.

Claim 8, as amended, recites in pertinent part: " A capacitor dielectric, comprising...a first high-K capacitor dielectric comprising a metallic element...and...a second high-K capacitor dielectric comprising said metallic element, having a lower oxygen density than said first high-K capacitor dielectric, and contacting said first high-K capacitor dielectric, wherein the first high-K capacitor dielectric manifests a greater oxidation than would an equivalent thickness of the second high-K capacitor dielectric,

further wherein the metallic element is not diffused from a surface supporting the first high-K dielectric layer and the second high-K dielectric layer.". (Emphasis added). Again, the Takehiro reference simply does not disclose this. Claim 8 is also therefore allowable over the applied reference. Claims depending from claim 8 are also allowable based upon the allowable form of the base claim and further in view of the additional limitations recited in the dependent claims.

Claim 12, as amended, presently recites: "A capacitor dielectric, comprising...a first high-K capacitor dielectric comprising a metallic element...and...a second high-K capacitor dielectric comprising said metallic element and contacting said first high-K capacitor dielectric...wherein said first high-K capacitor dielectric and said second high-K capacitor dielectric are oxides, wherein said first high-K capacitor dielectric contains a first amount of oxygen per unit volume, and wherein said second high-K capacitor dielectric contains a second amount of oxygen per unit volume different from said first amount, further wherein the first high-K capacitor dielectric manifests a greater oxidation than would an equivalent thickness of the second high-K capacitor dielectric, *and the metallic element is not diffused from a surface supporting the first high-K dielectric layer and the second high-K dielectric layer.*". (Emphasis added). Again, as discussed in greater detail above, the Takehiro reference simply does not disclose this. Claim 12 is presently allowable over the applied reference. Claims depending from claim 12 are also allowable based upon the allowable form of the base claim and further in view of the additional limitations recited in the dependent claims.

Claim 13, as amended, recites in pertinent part: "A capacitor structure, comprising...a first electrode layer...a dielectric layer disposed over said first electrode layer, wherein said dielectric layer comprises a plurality of consecutively-positioned sub-layers, wherein each of said sub-layers comprises a high-dielectric-constant material, wherein said dielectric layer comprises an element common to all sub-layers of said plurality, and wherein one of said sub-layers is more oxidized than another of said sub-layers so that at least one of the sub-layers of the dielectric layer manifests greater oxidation than would an equivalent thickness of an underlying sub-layer of the dielectric layer, *further wherein the element common to all of the sub-layers is not diffused from the*

first electrode layer into the sub-layers...". (Emphasis added). Claim 13 is also presently allowable over the applied reference. Claims depending from claim 13 are also allowable based upon the allowable form of the base claim and further in view of the additional limitations recited in the dependent claims.

Claim 63, as amended, recites: "A capacitor dielectric, comprising a plurality of capacitor dielectric layers, wherein each layer of the plurality is a high-K dielectric, wherein at least one layer of the plurality manifests a greater oxidation than would be present in an equal thickness of an underlying layer of the plurality, and wherein each layer of the plurality comprises a metal oxide included within an adjacent layer of the plurality, *further wherein a metal of the metal oxide is not diffused from a supporting surface into the plurality of layers.*". (Emphasis added). Claim 63 is therefore presently allowable over the applied reference. Claims depending from claim 63 are also allowable based upon the allowable form of the base claim and further in view of the additional limitations recited in the dependent claims.

Finally, claim 67 recites in pertinent part: "A capacitor dielectric, comprising a plurality of capacitor dielectric layers, wherein each layer of the plurality is a high-K dielectric, further wherein at least one layer of the plurality manifests a greater oxidation than would an equal thickness of an underlying layer of the plurality, wherein each layer of the plurality comprises a metal oxide included within an adjacent layer of the plurality, and wherein the underlying layer includes a means to minimize oxidation beyond the plurality of capacitor dielectric layers, *further wherein a metal of the metal oxide is not diffused from a supporting surface into the plurality of layers.*". (Emphasis added). Again, the applied reference does not disclose this. Claim 67 is allowable. Claims depending from claim 63 are also allowable based upon the allowable form of the base claim and further in view of the additional limitations recited in the dependent claims.

In view of the foregoing, Applicants respectfully request removal of all claim rejections based upon 35 U.S.C.§102(e).

§103 Rejection of the Claims

Claims 5-7, 52, 53, 62, 64-66 and 68-70 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the Takehiro reference. Applicants again disagree with the Examiners rejections, and again request reconsideration of the present application in light of the present amendments and following remarks.

As a preliminary matter, Applicants fail to understand the relevance of the Examiner's remarks regarding U.S. Patent No. 6,362,068 to Summerfelt, *et al.*, which are included in the present Office Action at page 4, third paragraph. Although Applicants acknowledge that the foregoing reference is art of record in the present case, Applicants cannot see how the reference is applied in the present rejections.. Accordingly, Applicants are refraining from offering any further discussion regarding this reference, and, further, categorically state that the present claims are distinguishable over this reference.

In applying the Takehiro reference, the Examiner acknowledges that the reference fails to explicitly disclose that at least two layers of a plurality of dielectric layers exhibit different degrees of oxidation. Nevertheless, the Examiner asserts that the recitation of a layer of a plurality of dielectric layers having lower oxygen concentration suggests different degrees of oxidation. Applicants respond that the present claims are distinguishable for still other reasons.

Returning again to the claims, specific differences between the Takehiro reference and the claim language will be specifically pointed out. Claim 52, as amended, recites in pertinent part: "A capacitor dielectric, comprising a plurality of capacitor dielectric layers defining a total thickness ranging from 50 to 70 angstroms, wherein each layer of said plurality is a high-K dielectric defining an individual thickness ranging from 10 to 40 angstroms in thickness, wherein at least one layer of said plurality manifests greater oxidation than would an equal thickness of an underlying layer of said plurality, and wherein each layer of said plurality comprises a metal oxide included within an adjacent layer of said plurality, *further wherein a metal of the metal oxide is not diffused from a supporting surface into the plurality of layers*.". (Emphasis added). As discussed in greater detail above, the Takehiro reference does not disclose or fairly suggest this.

Instead, Takehiro *explicitly relies* on a diffusion of ruthenium from the electrode and into at least one of the dielectric layers. Accordingly, Takehiro explicitly *teaches away*. Claim 52 is allowable. Claims depending from claim 52 are also allowable based upon the allowable form of the base claim and further in view of the additional limitations recited in the dependent claims.

Claim 62, as amended, recites in pertinent part: "A capacitor dielectric, comprising a plurality of capacitor dielectric layers defining a total thickness ranging from 50 to 70 angstroms, wherein each layer of said plurality is a high-K dielectric defining an individual thickness ranging from 10 to 40 angstroms in thickness, wherein at least one layer of said plurality manifests greater oxidation than would an equal thickness of an underlying layer of said plurality, wherein each layer of said plurality comprises a metal oxide included within an adjacent layer of said plurality, and wherein the underlying includes a means to minimize oxidation beyond the plurality of capacitor dielectric layers, *further wherein a metal of the metal oxide is not diffused from a supporting surface into the plurality of layers*.". (Emphasis added). Again, Applicants submit that the Takehiro reference explicitly teaches away. Claim 62 is allowable. Claims depending from claim 62 are also allowable based upon the allowable form of the base claim and further in view of the additional limitations recited in the dependent claims.

With regard to the Examiner's rejection of claims 5-7, Applicants submit that the amendment to claim 1 fully addresses the Examiner's rejection. Similarly, the rejection of dependent claims 64-66 is addressed by the amendment of claim 63. The rejection of dependent claims 68-72 is also addressed by the amendment of claim 67.

In view of the foregoing, Applicants respectfully request removal of all claim rejections based upon 35 U.S.C.§103(a).

Reservation of Rights

In the interest of clarity and brevity, Applicant may not have addressed every assertion made in the Office Action. Applicant's silence regarding any such assertion does not constitute any admission or acquiescence. Applicant reserves all rights not

exercised in connection with this response, such as the right to challenge or rebut any tacit or explicit characterization of any reference or of any of the present claims, the right to challenge or rebut any asserted factual or legal basis of any of the rejections, the right to swear behind any cited reference such as provided under 37 C.F.R. § 1.131 or otherwise, or the right to assert co-ownership of any cited reference. Applicant does not admit that any of the cited references or any other references of record is relevant to the present claims, or that they constitute prior art. To the extent that any rejection or assertion is based upon the Examiner's personal knowledge, rather than any objective evidence of record as manifested by a cited prior art reference, Applicant timely objects to such reliance on Official Notice, and reserves all rights to request that the Examiner provide a reference or affidavit in support of such assertion, as required by MPEP § 2144.03. Applicant reserves all rights to pursue any cancelled claims in a subsequent patent application claiming the benefit of priority of the present patent application, and to request rejoinder of any withdrawn claim, as required by MPEP § 821.04.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at (612) 349-9587 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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Date 29 Nov. '07

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Mail Stop Amendment, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 29th day of November 2007.

Amy Moriarty

Name

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